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NPS Student-Professor Team Assists Commander, U.S. Third Fleet With 'Splitting' Dilemma

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From left to right, Prof. Luke Brewer, Vice Adm. Richard Hunt, and Lt. Brian Banazwski, stand in front of the guided-missile USS Chosin (CG 65). (U.S. Navy photo by LCDR Zach McKeehan / Released.)

With 22 Ticonderoga-class cruisers (CG 47) exhibiting cracks in their superstructures, some up to nine feet in length, the Navy is facing a technically difficult and potentially costly challenge. Replacing the ship's superstructures would be an extremely costly venture in time and money and the Navy is looking for alternatives.

To add insight and innovative ideas to solving the problem of cracking cruisers, Commander of the U.S. Third Fleet, Vice Adm. Richard Hunt turned to researchers at the Naval Postgraduate School (NPS) to help develop cost effective solutions that would help to ensure a combat ready fleet.

"The Naval Postgraduate School provides a pool of our Navy's best technical and tactical experts," said Hunt. "Superstructure cracking on our cruisers is a complex issue that requires our best minds – in industry, in the shipyard, along the waterfront, and in academia."

To see first-hand the superstructure cracking of marine aluminum alloys used on the Navy cruisers, NPS Prof. Luke Brewer and his thesis student, Navy Lt. Brian Banazwski, from the Department of Mechanical and Aerospace Engineering (MAE) recently visited Pearl Harbor Naval Station at the invitation of Vice Adm. Hunt.

Hunt, Brewer and Banazwski toured the USS Chosin (CG 65) and the USS Port Royal (CG 73) for several hours evaluating the extent and sources of the cracking and to view the deployment of new repair technologies, such as composite patching and ultrasonic impact treating. During the tour, Brewer was presented an actual piece of the aluminum alloy from a bulkhead that was cut out of a crack location.

Hunt, a 1988 graduate of NPS' Telecommunications Systems Management program, has firsthand knowledge of the caliber of research conducted at NPS, and sees both the school's faculty and staff as a resource that can be leveraged towards solving critical and complex challenges that face the operational fleets.

"As a graduate and Fleet Commander, I recognize this expertise and see the opportunity to tap into both students and faculty in solving our most challenging issues," he said.

Innovation and creativity, coupled with premier research facilities make NPS an ideal place to look when formidable challenges arise. Hunt noted these characteristics as primary reasons he turned to his alma matter when trying to solve fleet problems.

"NPS emphasizes and encourages creative and 'out of the box' solutions to complex issues and problems," noted Hunt. "They are working to better understand the metallurgy characteristics which are necessary to predict the extent of the cracking and develop options to prevent or mitigate them."

Brewer is currently developing research plans with THIRD Fleet, Naval Sea Systems (NAVSEA) and the Naval Surface Warfare Center–Carderock Division to detect, monitor and conduct trend analysis of the "health" of the aluminum–magnesium alloys used aboard the vessels. The group is also working on innovative solutions to repair damaged structures.

"At NPS we're collaborating with NAVSEA and other scientists and engineers to come up with novel ways to repair cracks and corrosion damage," Brewer explained.

Repairing damaged materials is crucial to extending the lives and combat effectiveness of the cruisers, but Brewer also notes that most of his research is focused on the problem of failure prediction.

"I think the problem that most affects fleet readiness is being able to predict when and where you will next have a problem," he added. "As painful as it is to repair something we can deal with it, but not knowing when the next problem will be is really problematic."

At Brewer's direction students are working in NPS laboratories to collect data and conduct experiments on samples taken directly from the effected ships.
"One of the things we're currently doing is taking welds currently used on the plates and measuring their stress levels," noted Brewer. "In this case, we're taking a laboratory based technique, X-ray diffraction, and studying in the lab whether a welds from a shipboard sample is going to cause cracking problems in a laboratory setting."

An integral part of effective research is data collection, and collaborative efforts between NPS, NAVSEA and the Naval Surface Warfare Center–Carderock Division seek to improve the amount of information available to researchers taking part in the project. According to Brewer an ideal solution is to develop methods for collecting this information by crewmembers serving at sea.

"Right now we just don't have enough data. We know how and when we built the ship, we know what the material looked like, but what we don't have is the ability to monitor the materials actually on the ship," said Brewer. "Ideally if you could get a collection system all worked out it's something that can be done by crew members quarterly aboard the ship."

The effort to study shipbuilding metal health aims to increase prediction and forecasting of problems aboard Ticonderoga cruisers but Brewer believes this research has direct implications of improving overall readiness for other classes of Navy vessels.

NPS Prof. Luke Brewer, left, and thesis student, Navy Lt. Brian Banazwski, from the Department of Mechanical and Aerospace Engineering conduct research on a metal sample taken from the guided-missile cruiser USS Port Royal (CG 73). (U.S. Navy photo by MC1 Grant P. Ammon/Released.)

"This research is important for Ticonderoga class ships, but it's also important for the LCS class and the LHA class. They use similar materials and may have similar issues in the future," he said.

For Banazwski the project added to the richness of his learning experience at NPS by giving him the opportunity to study a real-world problem directly effecting fleet readiness.

"This research goes hand and hand with fleet readiness," noted Banazwski. "What we're working on here in the lab can be directly applied as solutions to the fleet."

According to Hunt, this interaction represents one of NPS' key elements; academic faculty training the future leadership of the U.S. Navy while helping to solve today's fleet challenges.

"Over the last 100 years, the Navy's readiness and warfighting capabilities have benefited from the close relationship between NPS and the Fleet," noted Hunt. "Key is the ability to leverage the technical expertise of not only the faculty and student body to solve complex issues but also their highly developed networks with industry, national labs, and other universities in coming up with cutting-edge options. Additionally, they provide state of the art solutions and are unbounded by conventional wisdom."